Banana Xanthomonas Wilt dynamics with mixed cultivars in a periodic environment

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Abstract

In this study, a non-autonomous model for the spread of Banana Xanthomonas Wilt disease (BXW) in a seasonally fluctuating environment is considered. Two categories of cultivars with different susceptible levels for inflorescence infection (AAA-genome and ABB-genome (highly susceptible)) were considered. Through mathematical and numerical analysis, threshold condition for existence and stability of both the disease-free equilibrium and periodic solution were obtained. From the sensitivity analysis of key parameters with respect to time-averaged basic reproduction number (R0), it was noted that R0 increases linearly with transmission parameters and declines exponentially with roguing parameters. It was also noted that the critical roguing rate of AAA-genome cultivars was less than that of ABB genome cultivar. The peaks in disease prevalence indicate the importance of effective implementation of controls during the rainy season. Controlling same cultivars via roguing and debudding led to much lower values of R0 as compared to between different cultivars. We conclude that highly susceptible cultivars play an important role in the spread of BXW and control measures should be effectively implemented during the rainy season if BXW is to be eradicated.